

Online Software-Based Event Selection at CDF II

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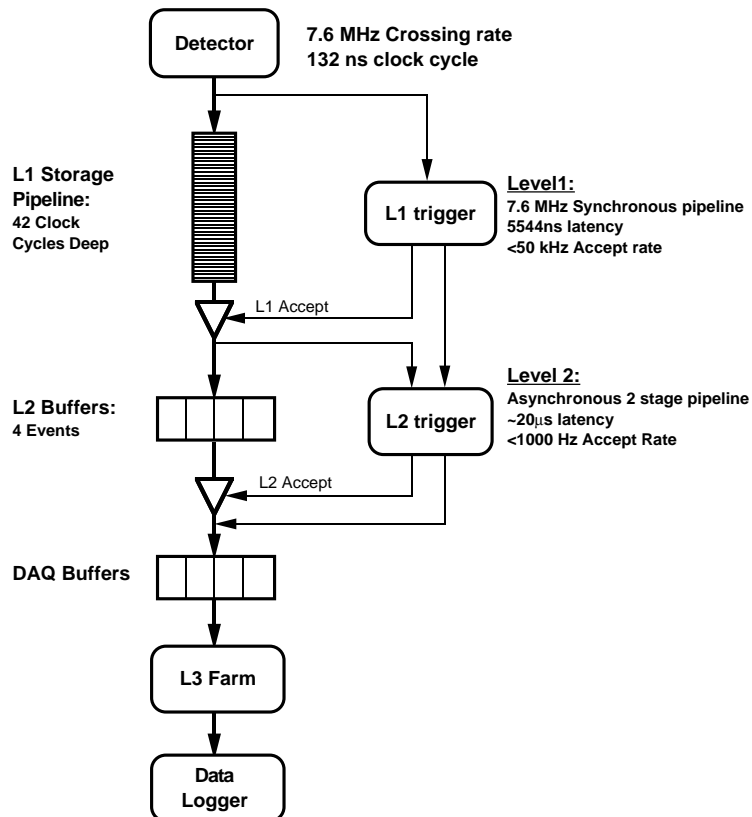


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Outline

1. Overview of CDF DAQ and Trigger
2. Level-3 Trigger
3. Data Hub and Monitoring
4. Performance and Conclusions

CDF Run II DAQ/Trigger



- Beam: 2.5MHz/7.6MHz

- L1: 50kHz

- L2: 300–1000Hz

- L3: 75Hz

Jobs for the High-Level DAQ/Trigger:

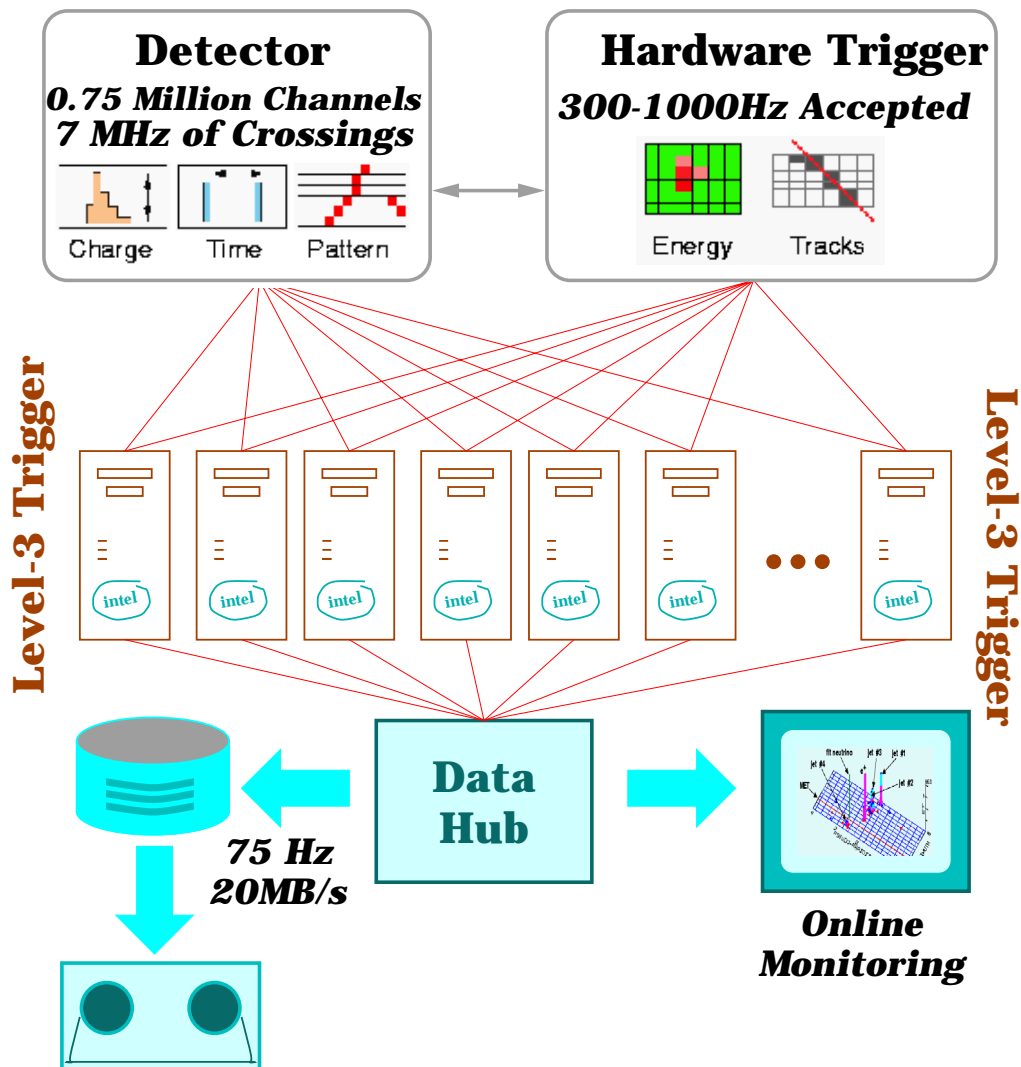
... reduce the dataset to 75 Hz logging limit (20 MB/s)

... prioritize raw data for processing

... select events for online monitoring

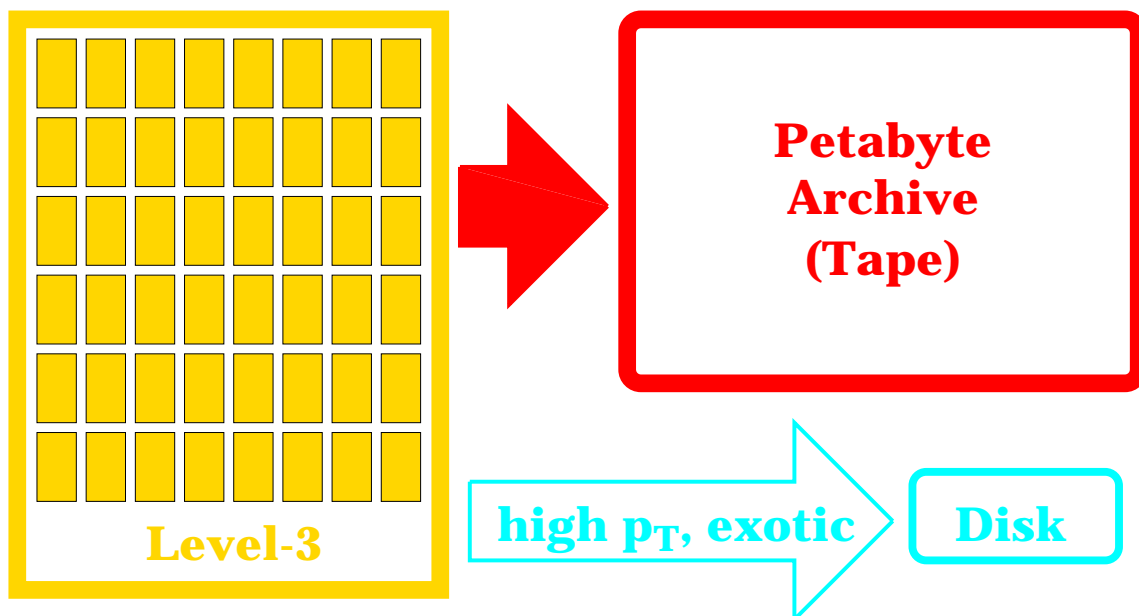
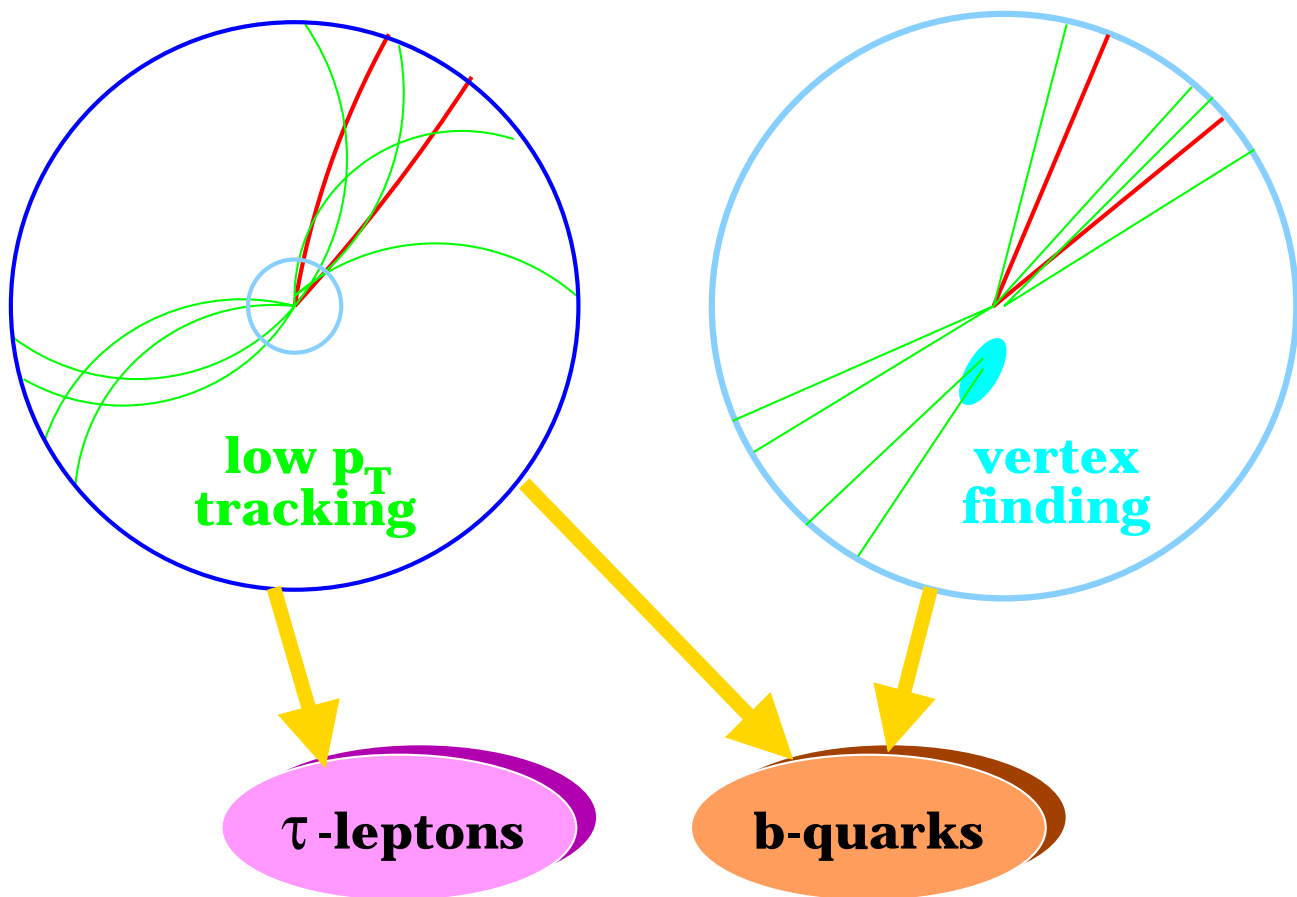
... use the opportunity to analyze an order of magnitude more data than can be written to tape!

Level-3 Trigger/Logger/Monitors



1. Input End: **ATM-Based Event-Builder**
(costly per port, outside scope of talk)
 2. Processors: **Require ~ 100 Gflops**
(c.f.: CDF Run I-B, ~ 2 Gflops)
 3. Throughput: **70–200 MB/s Built, 20 MB/s Logged**
- \Rightarrow **PC Farm solution** solves #2 ($\sim \$5/\text{Mflop}$),
but complicates #1 and #3

Level-3 and Physics Capabilities

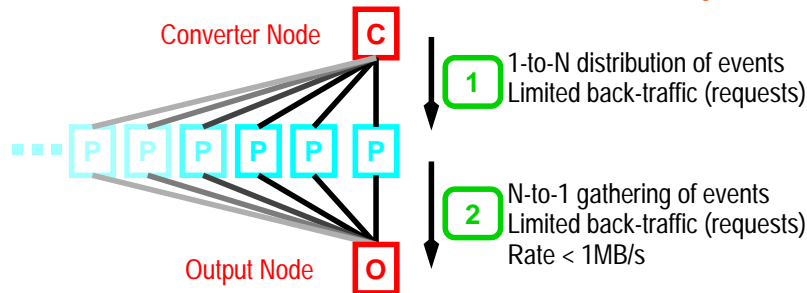


What's Under the Hood?

1. Intel-based PCs under Linux

- Leverage FNAL-CD Support of Linux/Intel
- CDF Offline “Vacation Cottage”
(CDF Software Distributed to ~ 50 Linux nodes)

2. Fast Ethernet Connectivity

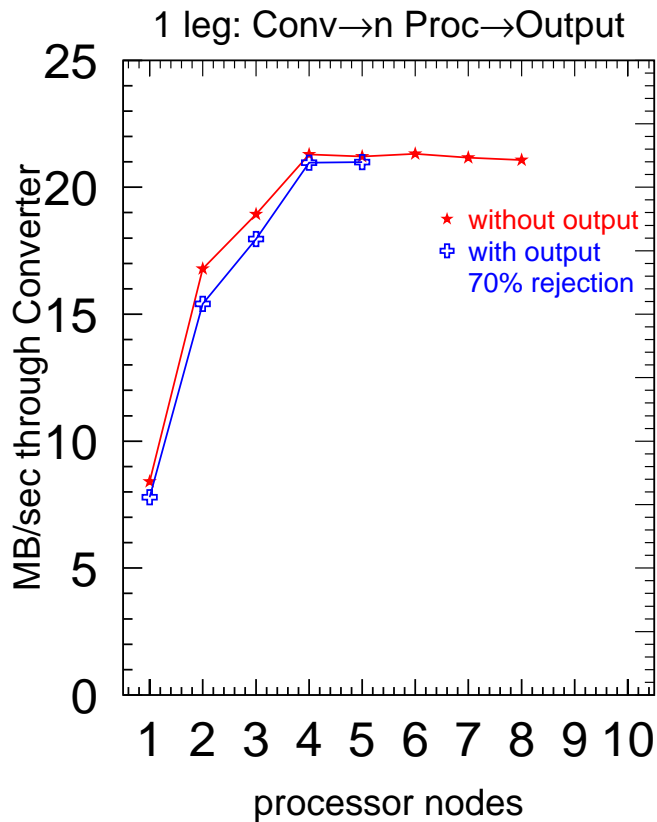
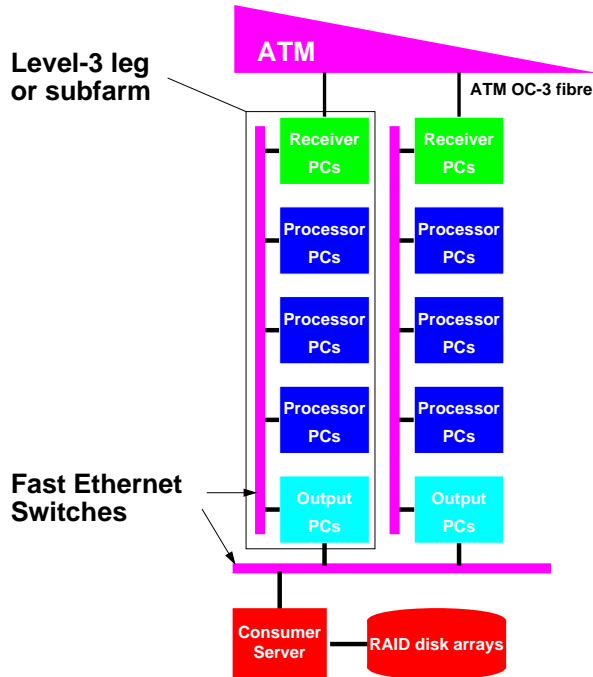


- Simple traffic – simple solution
- Parallelize for throughput where necessary
- Simple, homemade event distribution code

3. CDF Offline forms basis of Event Filter

- Integrate rather than translate reconstruction
- Offline reproducibility inherent
- Leverage existing CDF Offline infrastructure
- Level-3-specific code is developed in close conjunction with other Offline code

PC Farm Prototype and Performance



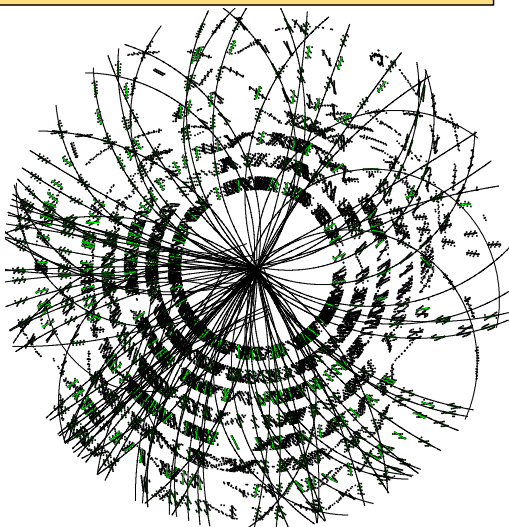
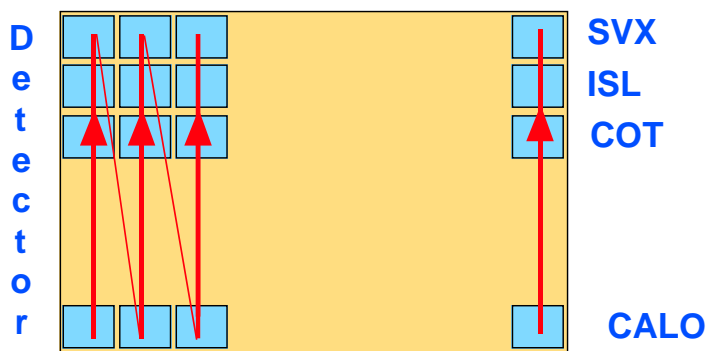
Algorithmic Framework for Level-3

Demands on Level-3 CPU

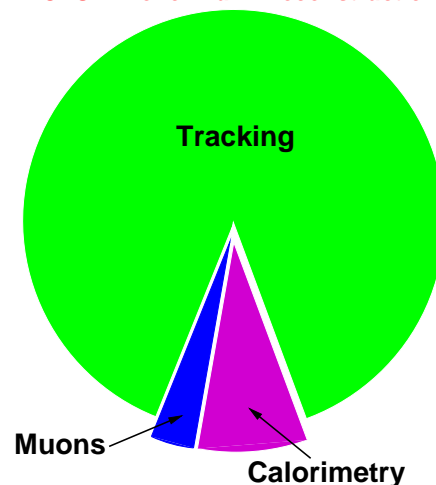
- Lepton/photon verification
(seeded by hardware triggers)
- Heavy flavor tagging
(often seeded by soft leptons, tracks, SVT)
- Multi-body reconstruction
(often of elements from hardware triggers)

⇒ Level-3 often driven by hardware trigger seeds

Regional Reconstruction



CPU Time for Run I Reconstruction



SVX/ISL and COT clear candidates for reconstruction with Seeded or Regional algorithms

Regional Tracking and Resources

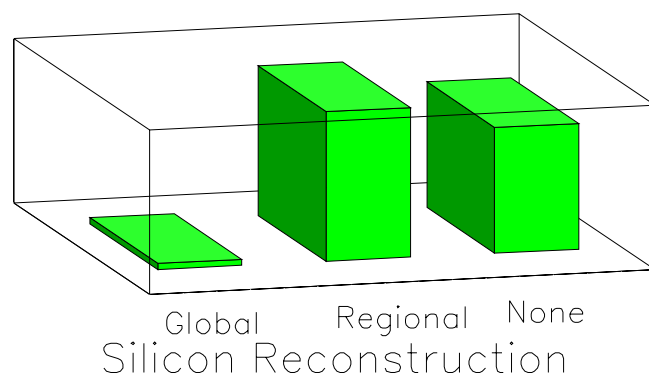
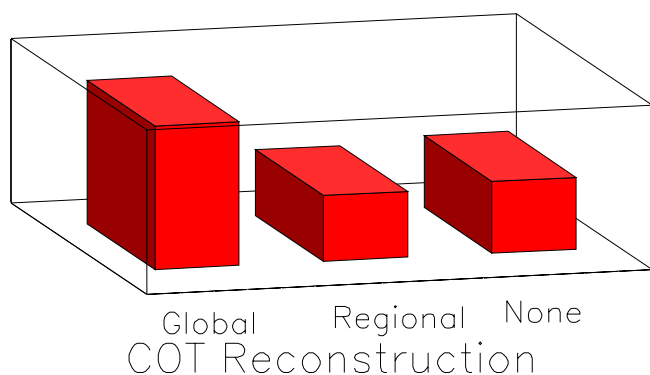


Design

Bottom-Up

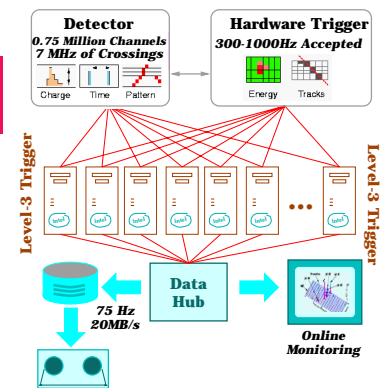
Specification

Level-2 Accept	300 Hz–1000 Hz	950 Hz
Level-3 Accept	75 Hz	75 Hz
CPU/event	0.44 sec	0.5 sec
(PII/400MHz/512kB-L2)		(2.5 sec w/o reg.)



- Required rejection rate is ~ 10
- CPU/event in line with expectations
- Regional Tracking key to achieving needed tracking power

Data Hub



- Data Hub connects **Level-3** to **Monitoring/Logger**

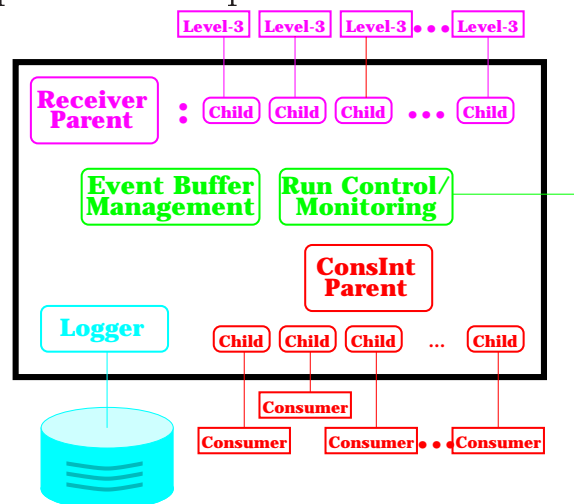
- ▷ ~ 20 MBps to Logger
- ▷ Serve tens of independent consumers
- ▷ Dynamic event requests (event display)

- Hardware

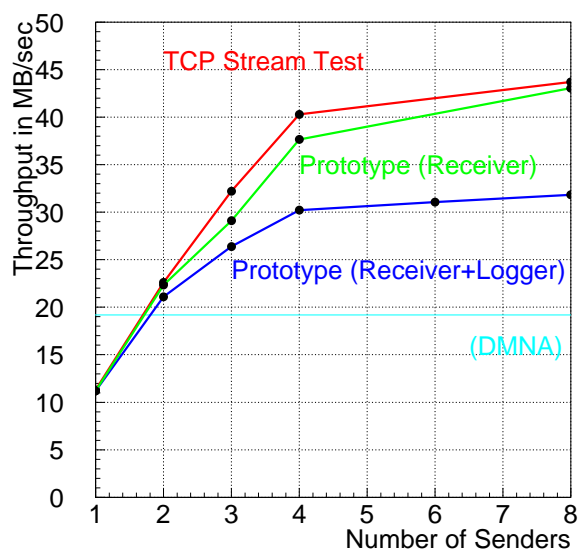
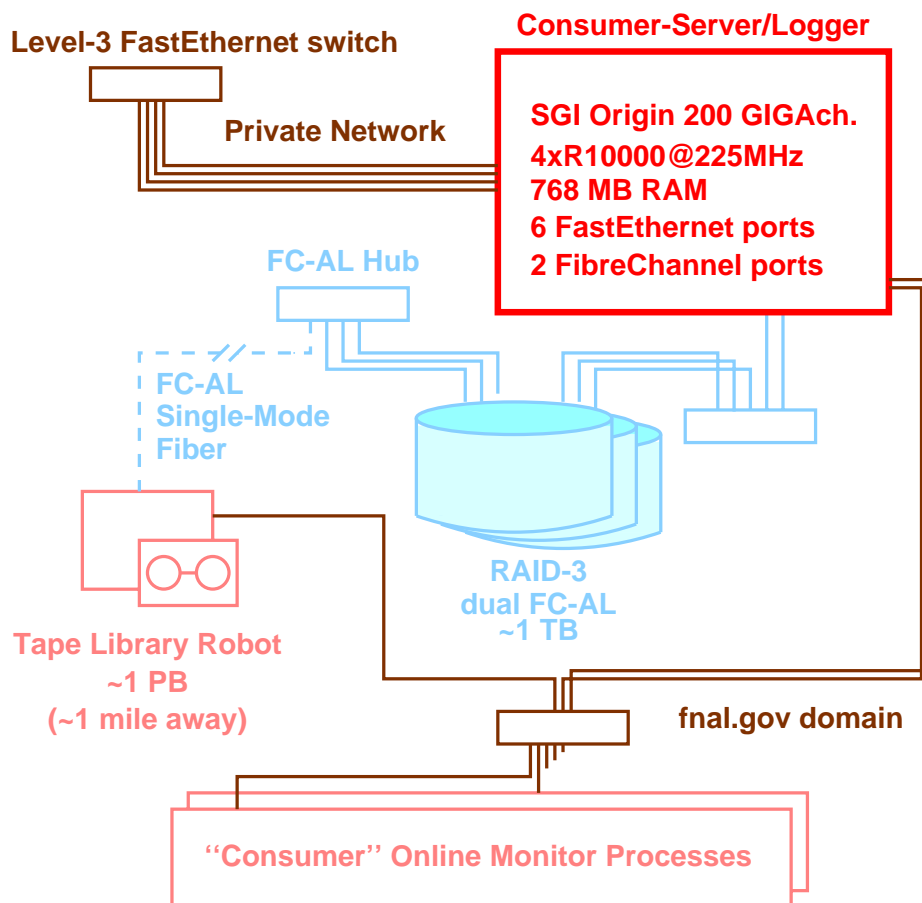
- ▷ SGI Origin 200 4 CPU Server
- ▷ RAID-3 Fibre Channel Disk Array
- ▷ Fast Ethernet for Level-3/Consumer Connections

- Software

- ▷ Dedicated event passing code
- ▷ Different functions implemented as state machines
- ▷ “Server” for Input and Output Clients



Performance of Data Hub



20MB/s throughput needed

Monitoring connectivity
established

Summary

1. Online Software-Based Event Selection necessary for exploitation of Run II Physics

- Level-3 can analyze an order of magnitude more data than goes to tape

2. Hardware/Software Development Progressing

- New Hardware design (PC Farm/Data Hub) prototyped; *necessary* to provide sufficient CPU and online monitoring
- Software must also conserve time while maintaining needed tracking functionality (regional tracking)

3. Access to data provided by Level-3 makes analyses faster and better

- Fast access to high p_T or rare events
- Highly enriched samples with b and τ tags can now be on saved on tape
- Monitoring capability enhanced by high bandwidth data hub

4. Level-3 increases the odds of making the discoveries that are possible in Run II